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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/821,404	03/29/2001	Ellen M. Eide	YOR20010072US1 (590.044)	3580
35195	7590	12/18/2003	EXAMINER	
FERENCE & ASSOCIATES 400 BROAD STREET PITTSBURGH, PA 15143			WOZNIAK, JAMES S	
			ART UNIT	PAPER NUMBER
			2655	
DATE MAILED: 12/18/2003				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/821,404

Applicant(s)

EIDE, ELLEN M.

Examiner

James S. Wozniak

Art Unit

2655

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03/29/2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

Detailed Action

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. **Claims 1-5 and 13-17** are rejected under 35 U.S.C. 102(b) as being anticipated by Nouza (*"Feature Selection Methods for Hidden Markov Model-based Speech Recognition"*).

With respect to **Claims 1 and 13**, Nouza recites:

A method and apparatus of facilitating speech recognition, said method comprising the steps of:

Obtaining speech input data (*HMM and DTW speech recognition systems, Page 188, Col. 1, Lines 5-7; Inherently, speech data would have to be received in order for speech to be recognized by the recognition system.*);

Building a model for each feature of an original set of features (*parameters used to distinguish models of different speech objects in the form of Gaussian mixture pdfs, Page 187, Col. 1, Lines 5-9, and evaluated for individual feature contributions for speech unit classification, Page 188, Col. 1, Lines 11-13*);

Ranking the features (*feature significance factor that can be used for ordering features, Page 188, Col. 1, last paragraph – Col. 2, first paragraph*); and

Building a model for each of a pre-selected number N of the ranked features (*reducing the size of feature vectors used in speech processing, Abstract, Lines 5-6, and identifying correct and incorrect speech models based upon those features, Page 188, Lines 26-32. It would be inherent, upon selection of principal components with the largest amount of variance used for separating hypothesis choices, that the principal component features being of a highest likelihood to represent a particular state within a HMM be used to remodel a most likely HMM candidate for speech recognition.*),

With respect to **Claims 2 and 14**, Nouza discloses:

The method and apparatus according to claims 1 and 13, respectively, wherein said step of building a model for each of a pre-selected number N of the ranked features comprises building a model for the top N ranked features (*reducing the size of feature vectors used in speech processing, Abstract, Lines 5-6, feature significance factor that can be used for ordering features, Page 188, Col. 1, last paragraph – Col. 2, first paragraph, and identifying correct and incorrect speech models based upon those features, Page 188, Lines 26-32. It would be inherent, upon selection of principal components with the largest amount of variance from an ordered component set used for separating hypothesis choices, that the principal component features being of a highest likelihood to represent a particular state within a HMM be used to remodel a most likely HMM candidate for speech recognition.*)

With respect to **Claims 3 and 15**, Nouza recites:

The method and apparatus according to claims 1 and 13, respectively, further comprising the step of compiling a confusion matrix for each feature of the original set of features subsequent to said step of building a model for each feature of an original set of features

(covariance matrix used to evaluate the contributions of a feature in speech classification and to determine whether a particular speech model is correct or incorrect, Page 188, Col. 1, Lines 11-32).

With respect to **Claims 4, 5, 16, and 17**, Nouza discloses:

The method and apparatus according to claims 3 and 15 and claims 4 and 16, respectively, wherein said step of compiling a confusion matrix comprises computing a score for each feature based on the likelihood, as a log-likelihood as per Claim 5, of its presence in a frame of the speech input data *(contribution of a feature within a covariance matrix in identifying a speech unit using a particular speech model, which is represented by a log-likelihood score, Page 188, Col. 1, Lines 13-23).*

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claim 6, 18, and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouza.

With respect to **Claim 6 and 18**, Nouza teaches the method and system of feature selection in recognizing a speech unit, utilizing a confusion matrix used to evaluate the

contributions of a feature in speech classification and to determine whether a particular speech model is correct or incorrect as applied to Claims 3 and 15. While Nouza does not teach it, it would have been obvious to one of ordinary skill in the art, at the time of invention, to compare the likelihood scores to a predetermined threshold as a means of detecting whether the feature is useful in picking the correct classification, a method well known in the art. Therefore it would have been obvious to compare likelihood scores to a predetermined threshold, to obtain the invention as recited in Claims 6 and 18.

With respect to **Claim 25**, Nouza teaches the method of feature selection in recognizing a speech unit as applied to Claim 1. While Nouza does not teach it, it would have been obvious to one of ordinary skill in the art, at the time of invention, to implement the method taught by Nouza using a computer program contained on a computer storage device, since computers are conveniently used and their programs easily updated for performing speech recognition operations, while a storage device would offer a means of storing any training databases or other necessary stored information. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of invention, to implement a feature selection method using a computer program transferable between various machines through the use of a storage device, thus increasing method adaptability, to obtain the invention as specified in Claim 25.

5. **Claims 7-12 and 19-24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouza in view of Gao et al (*US2002/0152069*).

With respect to **Claims 7, 8, 19, and 20**, Nouza teaches the method and system of feature selection in recognizing a speech unit, wherein contribution of a feature within a covariance matrix in identifying a speech unit using a particular speech model, is represented by a log-

likelihood score compared to a threshold and also ranked according to that log-likelihood score as respectively applied to Claims 6 and 18 and Claims 7 and 19. Nouza does not teach the calculation and the ranking of mutual information in the process of compiling a confusion matrix as respectfully recited in Claims 7 and 19 and Claims 8 and 20, however Gao recites:

The method and apparatus according to claims 4 and 16, respectively, wherein said step of compiling a confusion matrix further comprises calculating mutual information between truth and labels for each feature (*calculating mutual information in order to determine the best combination of features in the recognition of a speech unit, Paragraph 45, Lines 6-16*).

Nouza and Gao are analogous art because they are from a similar field of endeavor in feature selection for speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the calculation of mutual information in determining the best combination of features in the recognition of a speech unit as taught by Gao with the method and system of feature selection in recognizing a speech unit, wherein contribution of a feature within a covariance matrix in identifying a speech unit using a particular speech model, is represented by a log-likelihood score compared to a threshold as taught by Nouza to obtain a confusion matrix which contains information regarding threshold comparison and log-likelihood measurements as mutual information to increase the probability that the best features for recognition are selected. Also it would have been obvious to rank the mutual information through the means of ranking the log-likelihood score as taught by Nouza, since the log-likelihood is part of the mutual information measurement. Therefore, it would have been obvious to combine Gao with Nouza for the benefit of furthering method and system

reliability through the use of ranked mutual information in the form of threshold comparison and log-likelihood scores, to obtain the invention as specified in Claims 7, 8, 19 and 20.

With respect to **Claims 9, 11, 21, and 23**, Nouza teaches the method and system of feature selection in recognizing a speech unit as applied to Claim 1. Nouza does not teach the partitioning of speech input for each feature nor the production of an observation vector as recited in Claims 9, 11, 21 and 23, however Gao discloses:

The method and apparatus according to claims 1 and 13, respectively, wherein said step of building a model for each feature of an original and pre-selected set of features comprises: partitioning the speech input data in parallel, once for each feature; and producing an observation vector (*creating observation vectors which can be frames of speech, Paragraph 46, Lines 1-5, for use in a continuous speech recognition system, Paragraph 15, Lines 1-5*).

Nouza and Gao are analogous art because they are from a similar field of endeavor in feature selection for speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the generation of observation vectors as frames of speech as taught by Gao with the method and system of feature selection in recognizing a speech unit as taught by Nouza to create a more accurate method of speech recognition through the generation of observation vectors useable in a continuous speech recognition system. Also, it would have been obvious to one of ordinary skill in the art, at the time of invention, to generate an observation vector indicative of the speech pattern to be identified for the selected ranked features as applied to Claim 1 and recited by Nouza, to provide a higher likelihood that the speech unit will be properly recognized since the best features will be used to create the most probable HMM. Therefore, it would have been obvious to combine Gao

with Nouza for the benefit of obtaining a more accurate method of recognizing speech with the addition of observation vector generation for an original and pre-selected set of features and for use in a continuous speech recognition system, to obtain the invention as specified in Claims 9, 11, 21 and 23.

With respect to **Claims 10, 12, 22, and 24**, Nouza teaches the method and system of feature selection in recognizing a speech unit as applied to Claim 9. Nouza does not teach the partitioning of speech input for each feature, nor the production of final observations as recited in Claims 10, 12, 22, and 24, however, Gao discloses:

The method and apparatus according to claims 9, 21, 21, and 23, respectively, wherein said step of building a model for each feature of an original set of features comprises: partitioning data in parallel from the observation vector, once for each feature; and producing final observations (*creating observation vectors which can be frames of speech, Paragraph 46, Lines 1-5, for use in a continuous speech recognition system, Paragraph 15, Lines 1-5, and further generating features from the observation vectors used to recognize a speech pattern, Paragraph 11, Lines 1-6*).

Nouza and Gao are analogous art because they are from a similar field of endeavor in feature selection for speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the generation of final observations as feature vectors in a continuous recognition system as taught by Gao with the method and system of feature selection in recognizing a speech unit as taught by Nouza to create a more accurate method of speech recognition through the generation of observation vectors and further generating final observations as feature vectors as means of selecting the optimal features for

recognition. Also, it would have been obvious to one of ordinary skill in the art, at the time of invention, to generate an observation vector further generating feature vectors as final observations indicative of the speech pattern and optimal features for recognition, to be identified for the selected ranked features as applied to Claim 1 and recited by Nouza, to provide a higher likelihood that the speech unit will be properly recognized since the best features will be used to create the most probable HMM. Therefore, it would have been obvious to combine Gao with Nouza for the benefit of obtaining a more accurate method of recognizing speech with the addition of an observation vector to indicate a desired pattern to be recognized, further used to generate final observations as feature vectors to be optimized for recognition for use in a continuous speech recognition system, to obtain the invention as specified in Claims 10, 12, 22, and 24.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Nadas et al (*U.S. Patent: 4,926,488*)- teaches a speech processing system that selects best acoustic features in identifying speech.
- Sugawara et al ("Isolated word recognition using hidden Markov models")- teaches a method of speech recognition that includes creating a confusion matrix from labeled feature vectors.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to James S. Wozniak whose telephone number is (703) 305-8669

and email is Jwozniak@uspto.gov. The examiner can normally be reached on Mondays-Fridays, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Talivaldis Ivars Smits can be reached at (703) 306-3011. The fax/phone number for the Technology Center 2600 where this application is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the technology center receptionist whose telephone number is (703) 306-0377.

James S. Wozniak
12/12/2003



TALIVALDIS IVARS SMITS
PRIMARY EXAMINER